Remarks

The Office Action dated April 11, 2006 has been carefully reviewed and the foregoing amendment has been made in consequence thereof.

Claims 1-22 are pending in this application. Claims 1-22 stand rejected. Claims 23-27 have been cancelled.

In accordance with 37 C.F.R. 1.136(a), a one month extension of time is submitted herewith to extend the due date of the response to the Office Action dated April 11, 2006, for the above-identified patent application from July 11, 2006, through and including August 11, 2006. In accordance with 37 C.F.R. 1.17(a), authorization to charge a deposit account in the amount of $120.00 to cover this extension of time request also is submitted herewith.

The requirement for corrected drawings in compliance with 37 CFR 1.121(d) is respectfully traversed.

A replacement sheet containing Figure 5 is submitted herewith for approval. Figure 5 has been labeled as Prior Art as requested by the Examiner.

For the reasons set forth above, Applicants respectfully request that the requirement for corrected drawings be withdrawn.

The rejection of Claim 1 under 35 U.S.C. § 112, first paragraph, is respectfully traversed.

Claim 1 has been amended to recite " each said main coolant flow channel having its own means of controlling coolant flow that is separate from means of controlling coolant flow for each other main coolant flow channel". Paragraph [0024] describes that each fuel assembly has a main coolant flow channel and that each main coolant flow channel has a coolant orifice. Accordingly, Applicants submit that the subject matter of Claim 1 is described in such full, clear, and exact terms as to enable one skilled in the art to make and use the invention.

For the reasons set forth above, Applicants respectfully request that the Section 112, first paragraph, rejection of Claim 1 be withdrawn.

The rejection of Claims 1-22 under 35 U.S.C. § 112, second paragraph, is respectfully traversed.

As explained above, Claim 1 has been amended to recite " each said main coolant flow channel having its own means of controlling coolant flow that is separate from means of controlling coolant flow for each other main coolant flow channel". Applicants submit that claim 1 is definite and particularly points out and distinctly claims the subject matter which Applicants regard as their invention.

Further, Applicants submit that the term main coolant flow channel is described fully in paragraph [0024] and clearly illustrated in Figure 3. Particularly, paragraph [0024] describes that "[a] main coolant flow channel 88 extends from a coolant inlet 90 of fuel support 84 through fuel support 84 and lower tie plate 82 to fuel bundle 46 and permits coolant to flow up through fuel bundle 46 around fuel rods 92 contained inside fuel bundle 46". Applicants submit that the term main coolant flow channel is not vague nor indefinite. Accordingly, Applicants submit that Claims 1-22 meet the requirements of Section 112, second paragraph.

For the reasons set forth above, Applicants respectfully request that the Section 112, second paragraph, rejection of Claim 1 be withdrawn.

The rejection of Claims 1-7 and 13-16 under 35 U.S.C. § 102(b) as being anticipated over Church (US 5,198,185) is respectfully traversed.

Church describes a nuclear reactor core that includes a plurality of fuel assemblies that have an upper portion that is located inside a plenum. A universal sleeve housing extends around the fuel element. An upper portion of the housing is positioned in the plenum and the

lower portion surrounds the fuel element below the plenum. An orifice having a plurality of holes is positioned between the fuel element and the plenum. Church describes at Col. 1, lines 63-66, that "[e]ach position in the core may have a different orifice plate. The different plates have different numbers and arrangements of holes so that the flow of in each position may vary." Church does not describe a plurality of coolant orifices, with each coolant orifice comprising a diameter and located in the inlet of the main coolant flow channel of one of the plurality of fuel assemblies where the diameter of the coolant orifices located in a particular region of the core are substantially the same so that a flow of coolant through the main coolant flow channels of the fuel assemblies located in the particular region are substantially the same, and the diameter of the coolant orifices located in each region is different from the diameter of the coolant orifices in each other region so that the flow of coolant through the fuel assemblies in each region is different from the flow of coolant through the fuel assemblies in each other region.

Independent Claim 1 of the present application recites a nuclear reactor core that includes a plurality of fuel assemblies with each fuel assembly comprising a lower tie plate and a main coolant flow channel having an inlet. The plurality of fuel assemblies are arranged into at least three regions within the core, and each main coolant flow channel further includes a means of controlling a flow of coolant through the main coolant flow channel so that the flow of coolant through the main coolant flow channels of the fuel assemblies located in a particular region are substantially the same, and that the coolant flow through the fuel assemblies in each region is different from the coolant flow through the fuel assemblies in each other region. The means of controlling the flow of coolant through the main coolant flow channel is located in the inlet of the main coolant flow channel, and each main coolant flow channel having its own means of

controlling coolant flow that is separate from means of controlling coolant flow for each other main coolant flow channel.

Applicants respectfully submit that the Section 102 rejection of the presently pending claims is not a proper rejection. The Federal Circuit has opined that to anticipate a claim, a single source must contain all of the elements of the claim. See *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F2.d 137, 1379, 231 U.S.P.Q. 81, 90 (Fed. Cir. 1986). Also, missing elements may not be supplied by the knowledge of one skilled in the art or the disclosure of another reference. See *Structural Rubber Prods. Co. v. Park Rubber Co.*, 749 F.2d 707, 716, 223 U.S.P.Q. 1264, 1271 (Fed. Cir. 1984).

Church does not describe nor suggest a nuclear reactor core as recited in Claim 1. Particularly, Church does not describe nor suggest a core having a plurality of fuel assemblies with each having a main coolant flow channel that includes a means of controlling a flow of coolant through the main coolant flow channel so that the flow of coolant through the main coolant flow channels of the fuel assemblies located in a particular region are substantially the same, and that the coolant flow through the fuel assemblies in each region is different from the coolant flow through the fuel assemblies in each other region. Rather, Church teaches at Col. 1, lines 63-66, that "[e]ach position in the core may have a different orifice plate. The different plates have different numbers and arrangements of holes so that the flow of in each position may vary." Further, Church describes, at Col. 2, lines 53-55 that his invention does not include an orifice plate located in the fuel assembly. Accordingly, Applicants submit that Claim 1 is patentable over Church.

Claims 2-7 depend from independent Claim 1. When the recitations of dependent Claims 2-7 are considered in combination with the recitations of Claim 1, Applicants respectfully submit that Claims 2-7 likewise are patentable over Church.

Independent Claim 13 of the present application recites a nuclear reactor core that includes a plurality of fuel assemblies, with each fuel assembly including a lower tie plate and a main coolant flow channel having an inlet, and a plurality of coolant orifices with each coolant orifice including a diameter and located in an inlet of the main coolant flow channel of one of the plurality of fuel assemblies. The plurality of fuel assemblies are arranged into at least three regions within the core. The diameter of the coolant orifices located in a particular region are substantially the same so that a flow of coolant through the main coolant flow channels of the fuel assemblies located in the particular region are substantially the same, and the diameter of the coolant orifices located in each region is different from the diameter of the coolant orifices in each other region so that the flow of coolant through the fuel assemblies in each said region is different from the flow of coolant through the fuel assemblies in each other region.

Church does not describe nor suggest a nuclear reactor core as recited in Claim 13. Particularly, Church does not describe nor suggest a core having a plurality of fuel assemblies with each having a main coolant flow channel that includes a plurality of coolant orifices with each coolant orifice including a diameter and located in an inlet of the main coolant flow channel of one of the plurality of fuel assemblies, with the diameter of the coolant orifices located in a particular region being substantially the same so that the flow of coolant through the main coolant flow channels of the fuel assemblies located in a particular region are substantially the same, and that the coolant flow through the fuel assemblies in each region is different from the coolant flow through the fuel assemblies in each other region. Rather, Church teaches at Col. 1,

lines 63-66, that "[e]ach position in the core may have a different orifice plate. The different plates have different numbers and arrangements of holes so that the flow of in each position may vary." Further, Church describes, at Col. 2, lines 53-55 that his invention does not include an orifice plate located in the fuel assembly. Accordingly, Applicants submit that Claim 13 is patentable over Church.

Claims 12-16 depend from independent Claim 13. When the recitations of dependent Claims 12-16 are considered in combination with the recitations of Claim 13, Applicants respectfully submit that Claims 12-16 likewise are patentable over Church.

For the reasons set forth above, Applicants respectfully request that the Section 102(b) rejection of Claims 1-7 and 13-16 be withdrawn.

The rejection of Claims 1-22 under 35 U.S.C. § 102(b) as being anticipated over Congdon et al. (US 5,149,491) is respectfully traversed.

Congdon et al. describe a nuclear reactor core arrangement that includes mounting fuel bundles on orificed support stubs mounted on the core support. As described in Col. 4, lines 26-43, the fuel bundles are divided into three groups, a group of fresh bundles, a group of bundles at mid-life, and a group of bundles near the end of their useful life. The orificed support stubs are likewise divided into three groups, small-orificed stubs, large-orificed stubs, and peripheral stubs, which also have small orifices. The small-orificed stubs and the peripheral stubs define 1 inch apertures through the core support plate, while the large-orificed stubs define 2" apertures through the core support plate.

Congdon et al. do not describe nor suggest a nuclear reactor core as recited n Claim 1. Particularly, Congdon et al. do not describe nor suggest a each main coolant flow channel of fuel assembly includes a means of controlling a flow of coolant through the main coolant flow

channel so that the flow of coolant through the main coolant flow channels of the fuel assemblies located in a particular region are substantially the same, and that the coolant flow through the fuel assemblies in each region is different from the coolant flow through the fuel assemblies in each other region. Rather, Congdon et al. describe two regions, one that includes the small orificed stubs and a second that includes the peripheral stubs, that have the same diameter apertures (1 inch). Applicants submit that the flow through the peripheral bundles will be the same as the coolant flow through the fresh bundles mounted on the small orificed stubs. Therefore the limitation of Claim 1 that the coolant flow through the fuel assemblies in each region is different from the coolant flow through the fuel assemblies in each other region is not taught by Congdon et al. Accordingly, Applicants submit that Claim 1 is patentable over Congdon et al.

Claims 2-12 depend from independent Claim 1. When the recitations of dependent Claims 2-12 are considered in combination with the recitations of Claim 1, Applicants respectfully submit that Claims 2-12 likewise are patentable over Congdon et al.

Congdon et al. do not describe nor suggest a nuclear reactor core as recited n Claim 13. Particularly, Congdon et al. do not describe nor suggest a each main coolant flow channel of fuel assembly includes a coolant orifice with each coolant orifice including a diameter and located in an inlet of the main coolant flow channel of one of the plurality of fuel assemblies, with the diameter of the coolant orifices located in a particular region being substantially the same so that the flow of coolant through the main coolant flow channels of the fuel assemblies located in a particular region are substantially the same, and that the coolant flow through the fuel assemblies in each region is different from the coolant flow through the fuel assemblies in each other region. Rather, Congdon et al. describe two regions, one that includes the small orificed stubs and a

second that includes the peripheral stubs, that have the same diameter apertures (1 inch). Applicants submit that the flow through the peripheral bundles will be the same as the coolant flow through the fresh bundles mounted on the small orificed stubs. Therefore the limitation of Claim 13 that the coolant flow through the fuel assemblies in each region is different from the coolant flow through the fuel assemblies in each other region is not taught by Congdon et al. Accordingly, Applicants submit that Claim 13 is patentable over Congdon et al.

Claims 14-17 depend from independent Claim 13. When the recitations of dependent Claims 14-17 are considered in combination with the recitations of Claim 13, Applicants respectfully submit that Claims 14-17 likewise are patentable over Congdon et al.

Congdon et al. do not describe nor suggest a nuclear reactor core as recited n Claim 18. Particularly, Congdon et al. do not describe nor suggest a each main coolant flow channel of fuel assembly includes a coolant orifice with each coolant orifice including a diameter and located in an inlet of the main coolant flow channel of one of the plurality of fuel assemblies, with the diameter of the coolant orifices located in a particular region being substantially the same, and the diameter of the coolant orifices in each region is different from the diameter of the coolant orifices in each other region. Rather, Congdon et al. describe two regions, one that includes the small orificed stubs and a second that includes the peripheral stubs, that have the same diameter apertures (1 inch). Therefore the limitation of Claim 18 that the diameter of the coolant orifices in each region is different from the diameter of the coolant orifices in each other region is not taught by Congdon et al. Accordingly, Applicants submit that Claim 18 is patentable over Congdon et al.

Claims 19-22 depend from independent Claim 18. When the recitations of dependent Claims 19-22 are considered in combination with the recitations of Claim 18, Applicants respectfully submit that Claims 19-22 likewise are patentable over Congdon et al.

For the reasons set forth above, Applicants respectfully request that the Section 102(b) rejection of Claims 1-22 be withdrawn.

The rejection of Claims 1-22 under 35 U.S.C. § 103(a) as being unpatentable over Patterson (US 3,892,625) in view of Yasuyaki (JP 06-289178) is respectfully traversed.

Applicants submit that the Section 103 rejection of the pending claims is not proper because a *prima facie* case of obviousness has not been established. Particularly, and as explained below, the combination of the teachings of Patterson and the teachings of Yasuyaki do not describe nor teach all the recited limitations in the claims of the present application.

Patterson does not describe nor suggest a nuclear reactor core as recited in Claim 1. Particularly, Patterson does not describe nor suggest that the plurality of fuel assemblies are arranged into at least three regions within the core. Rather, Patterson describes that the fuel assemblies are arranged into two regions in the core. Specifically, at Col. 3, lines 20-25, Patterson, referring to Figure 1, describes that "[i]n the region located outside line A are the restraint assemblies 18 and reflector assemblies, whereas in the region located between lines A and B are located the radial blanket fuel assemblies or breeder assemblies, and in the region inside line B are located the fuel assemblies". Applicants submit that restraint assemblies 18 are not fuel assemblies, but rather flow control devices to control the flow of coolant to a number of fuel assemblies. Further, the Office Action dated October 15, 2004, at page 3 admits that Patterson does not teach three core flow regions.

Further, Patterson does not describe nor suggest that each main coolant flow channel has its own means of controlling coolant flow that is separate from the means of controlling coolant flow for each other main coolant flow channel, so that the flow of coolant through the main coolant flow channels of the fuel assemblies located in a particular region are substantially the same, and that the coolant flow through the fuel assemblies in each region is different from the coolant flow through the fuel assemblies in each other region where the means of controlling flow is located in the inlet of the main coolant flow channel. Rather, Patterson describes that flow of coolant through several blanket fuel assemblies are controlled by one restraint assembly (a flow control device), see Figure 2. The main coolant flow channel of each blanket fuel assembly does not include its own separate means of controlling the coolant flow through the channel located in the inlet of the main coolant flow channel.

Yasuyaki is cited for teaching three flow rate regions. Yasuyaki is not cited for, and does not teach that main coolant flow channel of each fuel assembly has its own means of controlling coolant flow that is separate from the means of controlling coolant flow for each other main coolant flow channel. Rather, as best understood from the English language abstract, Yasuyaki describes tripartite flow rate regions of a reactor core. The cooling material is pumped by a single electromagnetic pump through the core. Yasuyaki describes that each flow rate in the regions 2-4 is adjusted to an optimum state. However, Yasuyaki does not describe nor suggest that each fuel assembly includes a main coolant flow channel and a separate means of controlling a flow of coolant through the main coolant flow channel. Yasuyaki only describes a pump for controlling the coolant flow through regions 2-4.

Patterson and Yasuyaki, alone or in combination, do not describe nor suggest a nuclear reactor core as recited in Claim 1. Particularly, Patterson and Yasuyaki, alone or in combination,

do not describe nor suggest that each fuel assembly in the core includes a main coolant flow channel and that each main coolant flow channel has its own means of controlling coolant flow that is separate from the means of controlling coolant flow for each other main coolant flow channel, so that the flow of coolant through the main coolant flow channels of the fuel assemblies located in a particular region are substantially the same, and that the coolant flow through the fuel assemblies in each region is different from the coolant flow through the fuel assemblies in each other region. As explained above, Patterson does not describe nor suggest that each fuel assembly in the core includes a main coolant flow channel and that each main coolant flow channel includes a separate means of controlling a flow of coolant through the main coolant flow channel that is located in the inlet of the main coolant flow channel, and Yasuyaki does not describe nor suggest that each fuel assembly in the core includes a main coolant flow channel and that each main coolant flow channel includes a separate means of controlling a flow of coolant through the main coolant flow channel that is located in the inlet of the main coolant flow channel. Combining the teachings of Patterson and Yasuyaki does not provide or suggest a reactor core where each fuel assembly in the core includes a main coolant flow channel and that each main coolant flow channel includes its own means of controlling a flow of coolant through the main coolant flow channel that is located in the inlet of the main coolant flow channel. Accordingly, Applicants submit that independent Claim 1 is patentable over Patterson and Yasuyaki, alone or in combination.

Claims 2-12 depend from independent Claim 1. When the recitations of dependent Claims 2-12 are considered in combination with the recitations of Claim 1, Applicants respectfully submit that Claims 2-12 likewise are patentable over Patterson and Yasuyaki, alone or in combination.

Patterson does not describe nor suggest a nuclear reactor core as recited in Claim 13. Particularly, Patterson does not describe nor suggest a nuclear reactor core that includes a plurality of coolant orifices with each coolant orifice including a diameter and located in an inlet of the main coolant flow channel of one of the plurality of fuel assemblies and that the diameter of the coolant orifices located in a particular region are substantially the same so that a flow of coolant through the main coolant flow channels of the fuel assemblies located in the particular region are substantially the same, and the diameter of the coolant orifices located in each region is different from the diameter of the coolant orifices in each other region so that the flow of coolant through the fuel assemblies in each said region is different from the flow of coolant through the fuel assemblies in each other region.

Applicants respectfully disagree with the suggestion, at page 6 of the present Office Action, that "Patterson clearly discloses a plurality of coolant orifices (see, for example Figure 2 items 104 and 52) located in the inlet of the main coolant flow channel of each respective fuel assembly". Applicants submit that slot 52 is not an orifice located in the inlet of the main coolant flow channel of the fuel assembly. Particularly, Patterson describes at Col. 6, lines 25-27 that "slots 52 located in sleeve 100 that makes up part of the lower support structure 102". Further, Applicants submit that hole 104 is not an orifice located in the inlet of the main coolant flow channel of the fuel assembly. Particularly, Patterson describes at Col. 6, lines 27-28 that "[t]hese slots are aligned with small holes 104 in lower nozzles 106 of the radial blanket fuel assemblies 63". Applicants submit that a hole 104 might be considered an inlet of the main coolant channel, but one skilled in the art would not consider hole 104 an orifice located in the inlet of the main coolant flow channel of the fuel assembly.

As explained above, Yasuyaki is cited for teaching three flow rate regions. Yasuyaki is not cited for, and does not teach that main coolant flow channel of each fuel assembly further includes a separate means of controlling a flow of coolant through the main coolant flow channel of the fuel assembly. Rather, as best understood from the English language abstract, Yasuyaki describes tripartite flow rate regions of a reactor core. The cooling material is pumped by a single electromagnetic pump through the core. Yasuyaki describes that each flow rate in the regions 2-4 is adjusted to an optimum state. However, Yasuyaki does not describe nor suggest that each fuel assembly includes a main coolant flow channel and a separate means of controlling a flow of coolant through the main coolant flow channel. Yasuyaki only describes a pump for controlling the coolant flow through regions 2-4.

Patterson and Yasuyaki, alone or in combination, do not describe nor suggest a nuclear reactor core as recited in Claim 13. Particularly, and for the reasons explained above, Patterson and Yasuyaki, alone or in combination, do not describe nor suggest a nuclear reactor core that includes a plurality of coolant orifices with each coolant orifice including a diameter and located in an inlet of the main coolant flow channel of one of the plurality of fuel assemblies and that the diameter of the coolant orifices located in a particular region are substantially the same so that a flow of coolant through the main coolant flow channels of the fuel assemblies located in the particular region are substantially the same, and the diameter of the coolant orifices located in each region is different from the diameter of the coolant orifices in each other region so that the flow of coolant through the fuel assemblies in each said region is different from the flow of coolant through the fuel assemblies in each other region. Accordingly, Applicants submit that independent Claim 13 is patentable over Patterson and Yasuyaki, alone or in combination.

Claims 14-17 depend from independent Claim 13. When the recitations of dependent Claims 14-17 are considered in combination with the recitations of Claim 13, Applicants respectfully submit that Claims 14-17 likewise are patentable over Patterson and Yasuyaki, alone or in combination.

Claim 18 recites a nuclear reactor core that includes a plurality of fuel assemblies, with each fuel assembly including a lower tie plate and a main coolant flow channel having an inlet; and at least one of a plurality of coolant orifices and a plurality of flow restriction devices. Each coolant orifice includes a diameter and is located in the inlet of a main coolant flow channel. Each restriction device is detachably coupled to a lower end of the lower tie plate and includes a plurality of flow openings, with each flow opening having a diameter. The plurality of fuel assemblies are arranged into at least three regions within the core. The diameter of the coolant orifices located in a particular region are substantially the same, and the diameter of the coolant orifices of each region is different from the diameter of the coolant orifices in each other region. The flow restriction devices located in a particular region are sized so that a number of flow openings are the same, and the number of flow openings of the flow restriction devices of each region is different from the number of flow openings of the flow restriction devices of each other region.

Patterson does not describe nor suggest a nuclear reactor core that includes a plurality of fuel assemblies, with each fuel assembly including a lower tie plate and a main coolant flow channel having an inlet; and at least one of a plurality of coolant orifices located in the inlet of the main coolant flow channel and a plurality of flow restriction devices detachably coupled to a lower end of the lower tie plate, and where the diameter of the coolant orifices located in a particular region are substantially the same, and the diameter of the coolant orifices of each

region is different from the diameter of the coolant orifices in each other region, and where the flow restriction devices located in a particular region are sized so that a number of flow openings are the same, and the number of flow openings of the flow restriction devices of each region is different from the number of flow openings of the flow restriction devices of each other region. For the reasons explained above, Applicants submit that Patterson does not describe nor suggest a nuclear reactor core that includes a plurality of coolant orifices with each coolant orifice including a diameter and located in an inlet of the main coolant flow channel of one of the plurality of fuel assemblies. In reference to the plurality of flow restriction devices detachably coupled to the lower end or the tie plate of the fuel assembly, Applicants submit that Patterson describes a flow restriction technique that includes the use of slots 52 located in sleeve 100 that makes up part of the lower support structure 102 and holes 104 located in the outer wall of the lower nozzles 106. However, the flow restriction apparatus is not detachably coupled to the lower tie plate of the fuel assembly.

As explained above, Yasuyaki is cited for teaching three flow rate regions. Yasuyaki is not cited for, and does not teach that main coolant flow channel of each fuel assembly further includes a separate means of controlling a flow of coolant through the main coolant flow channel of the fuel assembly. Rather, as best understood from the English language abstract, Yasuyaki describes tripartite flow rate regions of a reactor core. The cooling material is pumped by a single electromagnetic pump through the core. Yasuyaki describes that each flow rate in the regions 2-4 is adjusted to an optimum state. However, Yasuyaki does not describe nor suggest that each fuel assembly includes a main coolant flow channel and a separate means of controlling a flow of coolant through the main coolant flow channel. Yasuyaki only describes a pump for controlling the coolant flow through regions 2-4.

Patterson and Yasuyaki, alone or in combination, do not describe nor suggest a nuclear reactor core as recited in Claim 18. Particularly, and for the reasons explained above, Patterson and Yasuyaki, alone or in combination, do not describe nor suggest a nuclear reactor core that includes a plurality of fuel assemblies, with each fuel assembly including a lower tie plate and a main coolant flow channel having an inlet; and at least one of a plurality of coolant orifices located in the inlet of the main coolant flow channel and a plurality of flow restriction devices detachably coupled to a lower end of the lower tie plate.

Further, Applicants disagree with the suggestion at page 8 of the present Office Action that "applicant is attempting to rearrange the parts of Patterson by simply moving the orifices and flow openings from one place to another". Applicants submit that Patterson uses an orifice 31 to control coolant flow through a plenum 61 and into the blanket fuel assemblies 63 through slots 52 and holes 104. Applicants' reactor core utilizes a simplified technique of controlling coolant flow by eliminating the plenum and using an orifice in the inlet of each coolant flow channel and/or a flow restriction device attached to a lower tie plate of the fuel assembly. This simplified technique is not simply moving orifices and flow openings from one place to another.

For the reasons set forth above, Applicants submit that independent Claim 18 is patentable over Patterson and Yasuyaki, alone or in combination.

Claims 19-22 depend from independent Claim 18. When the recitations of dependent Claims 19-22 are considered in combination with the recitations of Claim 18, Applicants respectfully submit that Claims 19-22 likewise are patentable over Patterson and Yasuyaki, alone or in combination.

For the reasons set forth above, Applicants respectfully request that the Section 103(a) rejection of Claims 1-22 be withdrawn.

The rejection of Claims 8-12 and 17-22 under 35 U.S.C. § 103(a) as being unpatentable over the Background Of The Invention of the present application in view of Church is respectfully traversed.

The Background Of The Invention describes at paragraph [0008] that

> Known BWRs include two orifice regions usually designated as peripheral and center. The peripheral region includes all fuel locations around the periphery of the core, and the center region includes the remainder of the locations. The inlet orifice design limits the peripheral region flow per fuel element to about half of the flow per fuel element of the center region. Limiting the peripheral flow by this magnitude permits the very low power peripheral fuel elements to saturate the coolant flow, but the exit quality and average voids are still much lower than for the other higher power region. This uneven exit quality and average void can produce inefficient steam separation and nuclear moderation.

Applicants submit that the Background Of The Invention of the present application does not describe nor suggest a plurality of coolant orifices, with each coolant orifice comprising a diameter and located in the inlet of the main coolant flow channel of one of the plurality of fuel assemblies where the diameter of the coolant orifices located in a particular region of the core are substantially the same so that a flow of coolant through the main coolant flow channels of the fuel assemblies located in the particular region are substantially the same, and the diameter of the coolant orifices located in each region is different from the diameter of the coolant orifices in each other region so that the flow of coolant through the fuel assemblies in each region is different from the flow of coolant through the fuel assemblies in each other region. There is no description or suggestion in the Background Of The Invention that each orifice in a region has the same diameter so that the coolant flow is substantially the same through each fuel assembly.

Further, as explained above, Church does not describe nor suggest a core having a plurality of fuel assemblies with each having a main coolant flow channel that includes a

plurality of coolant orifices with each coolant orifice including a diameter and located in an inlet of the main coolant flow channel of one of the plurality of fuel assemblies, with the diameter of the coolant orifices located in a particular region being substantially the same so that the flow of coolant through the main coolant flow channels of the fuel assemblies located in a particular region are substantially the same, and that the coolant flow through the fuel assemblies in each region is different from the coolant flow through the fuel assemblies in each other region. Rather, Church teaches at Col. 1, lines 63-66, that "[e]ach position in the core may have a different orifice plate. The different plates have different numbers and arrangements of holes so that the flow of in each position may vary." Further, Church describes, at Col. 2, lines 53-55 that his invention does not include an orifice plate located in the fuel assembly.

Applicants submit that combining the teachings of the Background Of The Invention with Church does not describe nor suggest the recitations of Claims 8-12 and 17-22. Particularly, the Background Of The Invention and Church, alone or in combination, do not describe nor suggest a plurality of coolant orifices, with each coolant orifice comprising a diameter and located in the inlet of the main coolant flow channel of one of the plurality of fuel assemblies where the diameter of the coolant orifices located in a particular region of the core are substantially the same so that a flow of coolant through the main coolant flow channels of the fuel assemblies located in the particular region are substantially the same, and the diameter of the coolant orifices located in each region is different from the diameter of the coolant orifices in each other region so that the flow of coolant through the fuel assemblies in each region is different from the flow of coolant through the fuel assemblies in each other region. Applicants submit that a *prima facie* case of obviousness has not been established because the combination of the teachings of he Background Of The Invention and Church do not describe nor suggest all the limitations recited

in Claims 8-12 and 17-22 of the present application. Accordingly, Applicants submit that Claims 8-12 and 17-22 are patentable over the Background Of The Invention and Church, alone or in combination.

For the reasons set forth above, Applicants respectfully request that the Section 103(a) rejection of Claims 8-12 and 17-22 be withdrawn.

The rejection of Claims 1, 2, and 13 under 35 U.S.C. § 103(a) as being unpatentable over Baxi (US 4,303,474) in view of Yasuyaki (JP 06-289178) is respectfully traversed.

Applicants submit that the Section 103 rejection of the pending claims is not proper because a *prima facie* case of obviousness has not been established. Particularly, and as explained below, the combination of the teachings of Baxi and the teachings of Yasuyaki do not describe nor teach all the recited limitations in the claims of the present application.

Baxi does not describe nor suggest a nuclear reactor core as recited in Claim 1. Particularly, Baxi does not describe nor suggest that the plurality of fuel assemblies are arranged into at least three regions within the core. Rather, Baxi describes that the fuel assemblies are arranged into two regions in the core, a region of blanket elements and a region of fuel elements. Specifically, at Col. 3, lines 9-15, Baxi , referring to Figure 1, describes that the core includes a plurality of fuel elements and a plurality of blanket elements. "The blanket elements are arranged in three rows around the fuel elements, and the core assembly assumes a hexagonal shape". Also, Baxi does not describe nor suggest that that each main coolant flow channel further includes a separate means of controlling a flow of coolant through the main coolant flow channel so that the flow of coolant through the main coolant flow channels of the fuel assemblies located in a particular region are substantially the same, and that the coolant flow through the fuel assemblies in each region is different from the coolant flow through the fuel assemblies in

each other region. Rather, Baxi describes that the blanket elements include a flow restrictor device in the main coolant conduit. However, Baxi does not describe nor suggest that the main coolant conduit of the fuel elements include a means of controlling the flow through the conduit so that the flow through each main coolant conduit of the fuel elements are substantially the same. Applicants submit that there is no teaching in Baxi that the coolant flow through the main coolant conduit of each of the blanket elements (which make up one region in the core) are the same and that the coolant flow through the main coolant conduit of each of the other fuel elements (which make up the second region of the core) are substantially the same.

As explained above, Yasuyaki is cited for teaching three flow rate regions. Yasuyaki is not cited for, and does not teach that main coolant flow channel of each fuel assembly further includes a separate means of controlling a flow of coolant through the main coolant flow channel of the fuel assembly so that the flow of coolant through the main coolant flow channels of the fuel assemblies located in a particular region are substantially the same, and that the coolant flow through the fuel assemblies in each region is different from the coolant flow through the fuel assemblies in each other region. Rather, as best understood from the English language abstract, Yasuyaki describes tripartite flow rate regions of a reactor core. The cooling material is pumped by a single electromagnetic pump through the core. Yasuyaki describes that each flow rate in the regions 2-4 is adjusted to an optimum state. However, Yasuyaki does not describe nor suggest that each fuel assembly includes a main coolant flow channel and a separate means of controlling a flow of coolant through the main coolant flow channel. Yasuyaki only describes a pump for controlling the coolant flow through regions 2-4.

Baxi and Yasuyaki, alone or in combination, do not describe nor suggest a nuclear reactor core as recited in Claim 1. Particularly, Baxi and Yasuyaki, alone or in combination, do not

describe nor suggest that each fuel assembly in the core includes a main coolant flow channel and that each main coolant flow channel includes a separate means of controlling a flow of coolant through the main coolant flow channel so that the flow of coolant through the main coolant flow channels of the fuel assemblies located in a particular region are substantially the same, and that the coolant flow through the fuel assemblies in each region is different from the coolant flow through the fuel assemblies in each other region. As explained above, Baxi does not describe nor suggest that each fuel assembly in the core includes a main coolant flow channel and that each main coolant flow channel includes a separate means of controlling a flow of coolant through the main coolant flow channel that is located in the inlet of the main coolant flow channel, and Yasuyaki does not describe nor suggest that each fuel assembly in the core includes a main coolant flow channel and that each main coolant flow channel includes a separate means of controlling a flow of coolant through the main coolant flow channel that is located in the inlet of the main coolant flow channel. Combining the teachings of Baxi and Yasuyaki does not provide or suggest a reactor core where each fuel assembly in the core includes a main coolant flow channel and that each main coolant flow channel includes a separate means of controlling a flow of coolant through the main coolant flow channel that is located in the inlet of the main coolant flow channel. Accordingly, Applicants submit that independent Claim 1 is patentable over Baxi and Yasuyaki, alone or in combination.

Claim 2 depends from independent Claim 1. When the recitations of dependent Claim 2 are considered in combination with the recitations of Claim 1, Applicants respectfully submit that Claim 2 likewise is patentable over Baxi and Yasuyaki, alone or in combination.

Baxi does not describe nor suggest a nuclear reactor core as recited in Claim 13. Particularly, Baxi does not describe nor suggest a nuclear reactor core that includes a plurality of

coolant orifices with each coolant orifice including a diameter and located in an inlet of the main coolant flow channel of one of the plurality of fuel assemblies and that the diameter of the coolant orifices located in a particular region are substantially the same so that a flow of coolant through the main coolant flow channels of the fuel assemblies located in the particular region are substantially the same, and the diameter of the coolant orifices located in each region is different from the diameter of the coolant orifices in each other region so that the flow of coolant through the fuel assemblies in each said region is different from the flow of coolant through the fuel assemblies in each other region.

Applicants disagree with the suggestion at page 10 of the current Office Action that Baxi teaches different orifice diameters in different core regions because "by placing flow restrictor (item 15) in the inlet orifice, the effective diameter of the orifice is diminished because the obstruction by said restrictor inherently changes the geometric configuration of the inlet, thereby reducing the overall effective diameter of said orifice". Applicants respectfully submit that there are no recitations relating to an "effective diameter" in Claim 13 of the present application. Claim 13 recites "said diameter of said coolant orifices located in a particular region are substantially the same . . . , and said diameter of said coolant orifices located in each region is different from the diameter of said coolant orifices in each other region . . . ." Baxi does not teach the nuclear reactor core recited in Claim 13.

Baxi and Yasuyaki, alone or in combination, do not describe nor suggest a nuclear reactor core as recited in Claim 13. Particularly, and as explained above, Baxi and Yasuyaki, alone or in combination, do not describe nor suggest that a nuclear reactor core that includes a plurality of coolant orifices with each coolant orifice including a diameter and located in an inlet of the main coolant flow channel of one of the plurality of fuel assemblies and that the diameter of the

coolant orifices located in a particular region are substantially the same so that a flow of coolant through the main coolant flow channels of the fuel assemblies located in the particular region are substantially the same, and the diameter of the coolant orifices located in each region is different from the diameter of the coolant orifices in each other region so that the flow of coolant through the fuel assemblies in each said region is different from the flow of coolant through the fuel assemblies in each other region. Accordingly, Applicants submit that independent Claim 13 is patentable over Baxi and Yasuyaki, alone or in combination.

For the reasons set forth above, Applicants respectfully request that the Section 103(a) rejection of Claims 1, 2, and 13 be withdrawn.

The rejection of Claims 1, 2, 13, and 18 under 35 U.S.C. § 102(a) as being unpatentable over Johansson et al. (DE 3150477A1) in view of Nakamura et al. (US 5,106,575) is respectfully traversed.

Independent Claims 1, 13, and 18 of the present application each recite a nuclear reactor core that include a plurality of fuel assemblies that are arranged into three regions within the core. The Office Action dated 10/15/04, at page 6 admits that Johansson et al. do not describe three regions of fuel assemblies. Nakamura et al. is cited for teaching arranging nuclear cores with a plurality of coolant flow rates arranged in three zones and the Office Action dated 8/30/05, at page 6, directs Applicants to Figure 5, Col.4, lines 56-58, and Col. 6, lines 1-22. Applicants submit that Nakamura et al. teaches a nuclear fuel assembly that has varying flow rate through a single fuel assembly and does not describe a nuclear reactor core where the fuel assemblies are arranged into at least three regions. Specifically, Figure 5 shows an idealized velocity distribution of the coolant flow rate above and in the vicinity of the lower tie plate of a single fuel assembly (see Col. 5, lines 58-60. Also, Col.4, lines 56-58, and Col. 6, lines 1-22

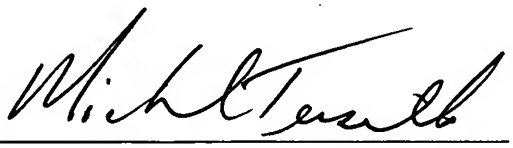
describe means of controlling the coolant flow in different areas within a single fuel assembly. Applicants submit that a *prima facie* case of obviousness has not been established because the combination of the teachings of Johansson et al. and Nakamura et al. do not describe nor suggest all the limitations recited in Claims 1, 13, and 18 of the present application. Accordingly, Applicants submit that Johansson et al. and Nakamura et al., alone or in combination, do not describe nor suggest a nuclear reactor core as recited in Claims 1, 13, or 18. Therefore, independent Claims 1, 13, and 18 are patentable over Johansson et al. and Nakamura et al., alone or in combination.

Claim 2 depends from independent Claim 1. When the recitations of dependent Claim 2 are considered in combination with the recitations of Claim 1, Applicants respectfully submit that Claim 2 likewise is patentable over Johansson et al. and Nakamura et al., alone or in combination.

For the reasons set forth above, Applicants respectfully request that the Section 103(a) rejection of Claims 1, 2, 13, and 18 be withdrawn.

In view of the foregoing amendments and remarks, all the claims now active in this application are believed to be in condition for allowance. Favorable action is respectfully solicited.

Respectfully submitted,



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